

WHAT IS CLAIMED IS:

Sub
A1

1. A method of generating comfort noise in a speech decoder that receives speech and noise information from a communication channel, comprising:

providing a plurality of comfort noise parameter values normally used by the speech decoder to generate comfort noise;

obtaining variability information indicative of variability of a background noise parameter;

in response to the variability information, modifying the comfort noise parameter values to produce modified comfort noise parameter values; and

using the modified comfort noise parameter values to generate comfort noise.

2. The method of Claim 1, wherein the background noise parameter is a spectrum parameter.

3. The method of Claim 1, wherein the background noise parameter is an energy parameter.

1 4. The method of Claim 1, wherein said obtaining
2 step includes obtaining variability information
3 indicative of variability of a background noise spectrum
4 parameter and a background noise energy parameter.

1 5. The method of Claim 1, wherein said obtaining
2 step includes computing from a plurality of values of the
3 background noise parameter a mean value of the background
4 noise parameter, and subtracting the mean value from each
5 background noise parameter value to produce a plurality
6 of deviation values.

1 6. The method of Claim 5, wherein said modifying
2 step includes selecting one of said deviation values
3 randomly, scaling the randomly selected deviation value
4 by a scale factor to produce a scaled deviation value,
5 and combining the scaled deviation value with one of the
6 comfort noise parameter values to produce one of the
7 modified comfort noise parameter values.

1 7. The method of Claim 1, wherein said speech
2 decoder is provided in a radio communication device.

1 8. The method of Claim 7, wherein speech decoder
2 is provided in a cellular telephone.

1 9. The method of Claim 1, wherein said obtaining
2 step includes the speech decoder obtaining the
3 variability information independently of the
4 communication channel.

1 10. The method of Claim 1, wherein said obtaining
2 step includes the speech decoder receiving the
3 variability information from a speech encoder via the
4 communication channel.

1 11. The method of Claim 1, wherein said variability
2 information includes mean variability information
3 indicative of how the background noise parameter varies
4 relative to a mean value of the background noise
5 parameter.

1 12. The method of Claim 11, wherein said obtaining
2 step includes using a plurality of values of the

3 background noise parameter to calculate a mean value of
4 the background noise parameter over a period of time, and
5 comparing the mean value to at least some of the
6 background noise parameter values to produce mean-removed
7 values of the background noise parameter.

1 13. The method of Claim 12, wherein said obtaining
2 step includes using the plurality of values of the
3 background noise parameter to calculate filter
4 coefficients, and filtering at least some of the mean-
5 removed values of the background noise parameter
6 according to the filter coefficients.

1 14. The method of Claim 13, wherein said last-
2 mentioned using step includes calculating filter
3 coefficients of an auto-regressive predictor filter.

1 15. The method of Claim 11, wherein said
2 variability information includes time variability
3 information indicative of how the background noise
4 parameter varies over time.

1 16. The method of Claim 1, wherein said variability
2 information includes time variability information
3 indicative of how the background noise parameter varies
4 over time.

1 17. An apparatus for producing comfort noise
2 parameters for use in generating comfort noise in a
3 speech decoder that receives speech and noise information
4 from a communication channel, comprising:

5 a first input for providing a plurality of comfort
6 noise parameter values normally used by the speech
7 decoder to generate comfort noise;

8 a second input for providing a background noise
9 parameter;

10 a modifier coupled to said first and second inputs
11 and responsive to variability characteristics of the
12 background noise parameter for modifying the comfort
13 noise parameter values to produce modified comfort noise
14 parameter values; and

15 ~~Sub A2~~ an output coupled to said modifier for providing
16 said modified comfort noise parameter values for use in
17 generating comfort noise.

1 18. The apparatus of Claim 17, wherein the
2 background noise parameter is a spectrum parameter.

1 19. The apparatus of Claim 17, wherein the
2 background noise parameter is an energy parameter.

1 20. The apparatus of Claim 17, wherein said
2 modifier includes a variability estimator coupled to said
3 second input and responsive to the background noise
4 parameter for producing said variability information.

1 ~~Sub A3~~ 21. The apparatus of Claim 20, wherein said
2 variability estimator includes a mean variability
3 determiner for producing mean variability information
4 indicative of how the background noise parameter varies
5 relative to a mean value of the background noise
6 parameter.

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1 22. The apparatus of Claim 21, wherein said mean
2 variability determiner is provided in the speech decoder.

1 23. The apparatus of Claim 21, wherein said mean
2 variability determiner is provided in a speech encoder
3 that is operable to communicate with the speech decoder
4 via the communication channel.

1 24. The apparatus of Claim 21, wherein said mean
2 variability determiner is responsive to a plurality of
3 values of the background noise parameter for calculating
4 a mean value of the background noise parameter over a
5 period of time, and is further operable to compare the
6 mean value to at least some of the background noise
7 parameter values to produce mean-removed values of the
8 background noise parameter.

1 25. The apparatus of Claim 24, wherein said
2 variability information includes time variability
3 information indicative of how the background noise
4 parameter varies over time.

1 26. The apparatus of Claim 25, wherein said
2 variability estimator includes a coefficient calculator
3 responsive to a plurality of values of the background
4 noise parameter for calculating filter coefficients, said
5 time variability information including the filter
6 coefficients.

1 27. The apparatus of Claim 26, wherein said filter
2 coefficients are filter coefficients of an auto-
3 regressive predictor filter.

1 28. The apparatus of Claim 26, including a filter
2 coupled to said coefficient calculator for receiving
3 therefrom said filter coefficients, and coupled to said
4 mean variability determiner for filtering at least some
5 of the mean-removed background noise parameter values
6 according to said filter coefficients.

1 29. The apparatus of Claim 26, wherein said
2 coefficient calculator is provided in the speech decoder.

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1. The first step is to identify the problem or goal. This involves understanding the current situation, identifying the key issues, and determining the desired outcome.